

2) Transformación a frecuencia

$$T(s) \Big|_{s=\frac{1}{w}} \Rightarrow T(j\omega) \Big|_{j\omega = \frac{1}{w} \cdot \frac{j}{j} = -\frac{j}{w}} \Rightarrow \boxed{\alpha = \frac{1}{|T(w)|} \Big|_{w=1}}$$

Pruebo con $n=2$

$$T_2(s) = \frac{3}{s^2 + 3s + 3} \Rightarrow T_2(s) = \frac{3}{\left(\frac{1}{s}\right)^2 + \frac{3}{s} + 3}$$

$$T_2(j\omega) = \frac{3}{(j\omega)^2 + 3j\omega + 3} \Rightarrow T_2(j\omega) = \frac{3}{\left(-\frac{j}{w}\right)^2 + 3 \cdot \left(-\frac{j}{w}\right) + 3}$$

$$T_2(j\omega) \Big|_{w=1} = \frac{3}{-1 - 3j + 3} \Rightarrow |T_2(w)| \Big|_{w=1} = \frac{3}{\sqrt{2^2 + 3^2}} = 0,832$$

$$\alpha = \frac{1}{|T_2(w)|} \Big|_{w=1} = \frac{1}{0,832} = 1,201 > \alpha_{MAX} \Rightarrow n=2 \times$$

Pruebo con $n=3$

$$T_3(s) = \frac{15}{s^3 + 6s^2 + 15s + 15} \Rightarrow T_3(s) = \frac{15}{\left(\frac{1}{s}\right)^3 + 6\left(\frac{1}{s}\right)^2 + \frac{15}{s} + 15}$$

$$T_3(j\omega) = \frac{15}{(j\omega)^3 + 6(j\omega)^2 + 15j\omega + 15} \Rightarrow T_3(j\omega) = \frac{15}{\left(-\frac{j}{w}\right)^3 + 6\left(-\frac{j}{w}\right)^2 + 15\left(-\frac{j}{w}\right) + 15}$$

$$T_3(j\omega) \Big|_{w=1} = \frac{15}{j - 6 - 15j + 15} \Rightarrow |T_3(w)| \Big|_{w=1} = \frac{15}{\sqrt{9^2 + 14^2}} = 0,901$$

$$\alpha = \frac{1}{|T_3(w)|} \Big|_{w=1} = \frac{1}{0,901} = 1,09 \simeq \alpha_{MAX} \Rightarrow n=3 \checkmark$$

$$\boxed{T(s)_{MIN} = \frac{15}{s^3 + 6s^2 + 15s + 15}}$$